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COMPARISON OF THE GLACIAL PHENOMENA OF NEW ENGLAND WITH THOSE OF EUROPE.

BY A. S. PACKARD, JR.

DURING a hurried tour through the Alps and Norway, I endeavored to observe marks of ancient glaciers in those countries in order to compare them with the phenomena to be observed in our northern states. The impression made on my mind, and I doubt not on that of other Americans who have travelled in the Alps and Scandinavia, was that the evidences of the former presence of glaciers, in valleys at the heads of which are glaciers now existing, were scarcely more distinct than in the valleys of the White Mountains, of the Adirondacks and even the coast of New England.

As one approaches the Alps from the valley leading from Munich up to Kempten, it could be readily seen that near the lower mountains the valleys were flanked by rounded moraines, clothed with pines and firs, and no better marked than those in the valley of the Saco about Conway. Their presence was revealed by the clearings made in the forests in the same manner as in the White Mountains and the Adirondacks. In one important feature the marks were less apparent, as one does not see in the Alps the broad trains of boulders so common in New England, since they have been artificially removed * during centuries of occupation of the country.

It was more difficult to detect striated and rounded rocks in the Alpine valleys than I had imagined from the accounts of Alpine geologists and travellers.

It was wonderful how nature has sought as it were to conceal the work of the ice period, through atmospheric agencies, in remodelling the materials of moraines, in reducing their former proportions and covering them up by the rapid growth of forests. The same process has gone on in northeastern America, and it is not improbable that about the same amount of time has been consumed in the work; namely, the ice period was contemporary in

*Professor Guyot informs me that the Swiss farmers often bury the boulders below the reach of the plough. The larger ones are sometimes blasted and split into building stones, while others, as with us, have been used for building fences. In some cantons laws have been enacted protecting the more remarkable boulders. (See *NATURALIST*, Vol. vi, p. 713.)

both continents. During a stay of nearly three weeks in Switzerland, several days of which I spent on foot in crossing the principal passes, I was unable to find among the specimens, I had endeavored to obtain for the museum of the Peabody Academy, a boulder scratched and polished sufficiently to be a fair sample of such work. Those that I did obtain *i.e.* small boulders, samples of glacial mud and gravel, could easily be mistaken for similar specimens from a glacial moraine at the mouth of the Peabody river at Gorham, New Hampshire. In all respects, this last named moraine is, in its glacial characters, the exact equivalent of the moraines at the edges of Alpine glaciers.

It is not until one crosses over by the great Scheideck Pass into the valley of Hasli that he sees the most magnificent examples of polished and grooved rocks, and on a scale perhaps exceeding anything in America. It was not to be wondered at, however, that geologists had been slow to realize that so large a portion of Switzerland had been glaciated.

In Sweden, but especially in Norway, where there are large glaciers and very extensive *mers de glace* on the summits of some of the mountain ranges, the ice marks are everywhere present, but scarcely more apparent than in the White Mountain valleys. At one place on a low rocky point projecting into the Sogne Fjord, there was a magnificent display of deeply grooved and furrowed rocks. But even with the marks at this locality, the enormous grooves on a hill within the city limits of Salem would compare favorably. In Norway, I was not able, so hasty was my journey over the country, to secure any samples from moraines recent enough to compare with moraines in the White Mountains. In Wales the glacial phenomena are on a diminutive scale compared even with the White Mountains, but in walking through the celebrated Pass of Llanberis the polished rocks, boulders and moraines, from one of which I was able to secure samples of glacial gravel, were of the same character as is to be seen in the White Mountains, and scarcely better marked.

Another point of much interest was the comparison of the glacial marine beds of Sweden and Norway with those of New England. While, as is well known, the life of the glacial epoch is almost identical in the two countries, the fossils found at Uddevalla in Sweden, as long since pointed out by Lyell, so exactly repeating the characteristic forms found by Bayfield in the clays of the river

St. Lawrence, and the few species peculiar to each deposit are migrations from the south—it was interesting to see that the lithological characters of the formation were the same in both. Approaching the Baltic coast of Sweden, and nearing the city of Stockholm, the train carries the traveller over extensive beds of clay with exactly the scenic features and color of those of the coast of Maine, presenting long slopes bounded by hillocks of pale gray clay with furrowed sides, worn into the same peculiar shapes by the rains. At the fine museum of the national Geological Survey, under the direction of Professor Torell, I was enabled to see a typical collection of the fossils of these clays. It was interesting to see the *Leda truncata* (L. Portlandica) so abundant in Maine beds, and the *Yoldia pygmaea* not infrequent in the Maine glacial beds. The abundance of this arctic *Leda* in deposits on both sides of the Atlantic shows how much more uniform was the marine life at that time. Changes in the level of the land, and consequently in its temperature, in the ocean currents, slight though they were, have brought about the changes in the distribution of life in the New England seas. Many arctic species and arctic varieties of species, though still living on our coast, are now to be sought in the abysses of our seas.

The explorations under the auspices of the United States Fish Commission, in the Coast Survey Steamer Bache last autumn (see Prof. Verrill's report in the Amer. Jour. Science, 1872), show how vividly we may restore the ancient marine life of the shores of New England and the St. Lawrence river below Montreal. Here, at a depth of 85–150 fathoms and over, were found living the *Arca pectunculoides*, so abundant in the glacial beds of Norway, though it has not been found in our glacial deposits. The discovery of this and other animals so near our shores, as well as the results of Count Pourtales' researches, and Mr. Whiteaves' dredgings in the Gulf of St. Lawrence, shows that the belt of arctic life as developed on the coast of Finmark at the present day extends southwards in all the deeper parts of the Atlantic ocean north of the West Indies, with its outliers in the Gulf of St. Lawrence. During the glacial period, when the sea stood two or three hundred feet deep over the present coast line of Maine, and still higher over that of the shores of the St. Lawrence Gulf, and Labrador, this belt of life was continuous up to the shallows and estuaries of the land during the period of the deposition of our clay beds. This fact should

stimulate us anew to prosecute with still greater ardor deep-sea dredgings off our coast, particularly the northeast extremity of the St. Georges Banks, with the hope of finding that now strangely interesting shell, *Leda truncata*, which has been brought home from the seas of Greenland in a recent state by arctic voyagers ; and on the other hand, to investigate the clay beds of the coast of New England, and Canada and Labrador with the hope of finding the *Arca pectunculoides*, which we can now with some degree of safety predict will be eventually found. The kind of bottom the writer found on the northeastern end of St. Georges Banks, and which proved so remarkably rich in molluscan and vermian life, was a sandy mud, much like that of the richest fossiliferous beds in our glacial formation.

We have but glanced at the identical features of the glacial phenomena of the Alps, Scandinavia and northeastern America, a matter which our geologists have doubtless each observed for themselves, and which struck Prof. Agassiz when he first arrived in this country after his years of exploration in the Alps, and journeys in Scotland and Wales, but which will perhaps suffer repetition in a popular journal of this character. As Humboldt early in this century expressed his delight at finding identical rocks in the New and Old World, the student of the superficial deposits that cover these rocks cannot restrain his delight at finding them almost identical in both hemispheres. Indeed it may be a comfort to the American student of glacial phenomena to know if he is debarred from visiting the glaciers of the Alps or Norway, or even those of the Rocky Mountains, that in the northern states, their marks are as freshly preserved as in the Old World, except at the very edge of the glaciers themselves when photographs will supply the place of actual vision.

THE COTTON CATERPILLAR.

BY LEWIS A. DODGE.

THERE are two kinds of insects which feed upon and destroy the cotton crop. The boll worm (Fig. 39, caterpillar and moth) eats only the bolls or pods containing the unripe cotton lint. It confines